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"Agriculture-All Around, Up and Down"

Biotechnology

Target Audience: Sixth Grade

School Year
2001-2002

School Federal Tax Identification Number
43-6004306

Agriculture- All Around, Up and Down
Biotechnology

Audience: Sixth Grade

Purpose: Our purpose is to inform future generations of the challenges they will face and problems they will have to solve in feeding the world population. The topic of biotechnology and how they may apply it to the future will be also addressed.

Materials: Soybean reference booklet, soybean pamphlet, soybeans, soybean products; coloring book, crayons, food, newspaper (see Appendix A for handouts) ElisaTest, BT corn, BT pictures, Olean chips, corn & soybean food products, wheat & rice food products, plates, and cups.

References: (See Appendix B)

Missouri Show-Me Standards:

Using these skills, students will acquire a solid foundation, which includes knowledge of and proficiency in: CA5, SC1, SC2, SC5, SC7, SC8, SS4, SS5, HPE5, HPE6.

Communications Arts:

1. comprehending and evaluating the content and artistic aspects of oral and visual presentations (such as story-telling, debates, lectures, multi-media productions)

Science:

1. properties and principles of matter and energy

2. changes in ecosystems and interactions of living organisms

3. processes (such as plate movement, water cycle, air flow) and interactions of Earth's biosphere, atmosphere, lithosphere and hydrosphere

4. processes of scientific inquiry (such as formulating and testing hypotheses)

5. impact of science, technology and human activity on resources and the environment

Social Studies:

1. economic concepts (including productivity and the market system) and principles (including the laws of supply and demand)

2. the major elements of geographical study and analysis (such as location, place, movement, regions) and their relationships to changes in society and environment

Health/Physical Education:

1. methods used to assess health, reduce risk factors, and avoid high-risk behaviors (such as violence, tobacco, alcohol and other drug use)

2. consumer health issues (such as the effects of mass media and technologies on safety and health)

Learning Activities/Experiments:

- Elisa Test
- Olean WOW potato
- Chip taste test
- Soybean product samples
- Corn product samples
- Wheat product samples
- Rice product samples

Introduction:

Today we are here to discuss a part of agriculture called biotechnology. Biotechnology seems like a big word at first, but if you break it down you can see that it is much easier to understand. Who knows what the prefix "Bio-" means? Bio means life. What about the word "technology"?

Technology is a scientific way of providing humans with sustenance and comfort for the present and future.

Did you know that today's population is exploding? Right now there are about 5.6 billion people in the world. About three people are born every second! That is equal to adding a city the size of Chicago to the world's population each month. The United States alone has 270 million people. People in the United States are expected to live until they are 74 years of age or older. This shows that the United States has a much higher rate of medical technology, dietary improvements, and safer environmental conditions, especially compared to third world countries who are expected to live only until they are 43.

Today's farmers make up less than two percent of the United States' population. This is tiny compared to the 90% who farmed during the American Revolution. Not to mention with the extreme decrease of space to farm. In the United States, 9500 acres of land daily is being taken out of production for shopping centers, parking lots, homes, subdivisions, and businesses. An acre is 43,560 square feet. If you can imagine a football field from end-zone to end-zone, that would be about the size of one acre. To accommodate for this change, our farmers must use technology to support life. Some of these changes are improving the quality of seeds planted and using pesticides and fertilizers. Pesticides are used to kill unwanted insects and other pests, and fertilizers are added to improve the quality and yields of the crops. Other ways of increasing crop yields is to improve farming techniques and equipment. These may include new designs, more refined engines, conservation tillage, contour farming, and satellite imagery. All of these changes are possible by applications of biotechnology.

The Body

Soybeans are useful in many ways. They are used in paints, inks, coatings, crayons, plastics, zebra food, margarine, yogurt, chocolate, candles, explosives, and potato chips. Everyone has heard of the WOW! Potato chips. They are made from Olean, which is made from soybean products. Olean is a vegetable oil substitute in which food products can be cooked. New uses are being found everyday. Our fossil fuels are decreasing daily due to our increasing population. There is an alternative fuel being developed from soybeans. It is clean burning, and can help clean up the air and environment.

This is what soybeans look like. (Show bag of beans/plants). These crayons have been made with soybean oil. They have a brighter color. Here are some crayons, coloring books, and bookmarks for you to keep.
(Pass out crayons and coloring books.)

Olean WOW! Test: (Hand out cups and plates for taste testing.) Each of you has a sample of regular and Olean-made potato chips. Take a bite of each type A and B. Now we will go around and take a poll to see which sample you think is the regular chip and which is the Olean. (Take Poll) As you can see we had various answers. It is hard to tell the difference. Soybean products can take the place of other products to produce a healthier way of living for all people. Olean chips made with soybean oil have no fat and half as many calories as regular chips. This is just one example of how biotechnology has improved the way we live by affecting our health.

Another example of how biotechnology has improved the quality of food is by changing the components of rice. Golden rice is fortified with beta-carotene in the United States and sent out to countries all over the world. Many people in these third world countries are malnourished and going blind. Beta-carotene is injected into the rice to maintain or save their eyesight.

More than one billion people throughout the world do not have enough food to meet their basic daily nutrition needs. However, United States farmers will have a surplus of 170 million bushels of soybeans this year. This seems to be the obvious answer. Many farmers want the United States Department of Agriculture to purchase the surplus of soybeans to feed more than sixty different hungry nations around the world. This surplus is due to the United States' ability to come up with new ideas for technology.

Corn is Missouri's second largest crop in production, producing nearly 300 million bushels of corn annually. Corn is our nation's top crop. Through applications of biotechnology a bushel of corn can produce; 32 pounds of starch, or 33 pounds of sweetener. It could also produce a combination of 2.7 pounds of ethanol, 11.4 pounds of gluten feed, 3 pounds of gluten meal, and 1.6 pounds of corn oil.

In the average supermarket, more than 4,200 products contain corn. Some of the many products produced using corn include: clothing, livestock feed,

soda, paper, ink, lotion, fireworks, detergents, toothpaste, aspirin, glue, canned goods and countless others. It is difficult to go through a day's activities without having corn involved.

BT Corn Experiment and Demonstration- This experiment will show you corn borers effect genetically altered corn versus unaltered corn. Corn borers are moths that lay eggs on the corn stalks and leaves. Once the eggs hatch, the larvae (or small worms) enter the corn plant and feed off the internal soft tissue. The internal tissues are made up of xylem and phloem. These tissues are like the pipes of the plants. Xylem takes water up from the roots, and phloem brings food down from the leaves. Once the larvae break this system, the plant can no longer function normally and will die. BT corn has an added supplement that allows the plant to produce an enzyme that is toxic to the larvae. This protection will allow a much increased crop yield. (Show pictures and stalks of corn. Also show BT Corn Plants.)

Elisa Test Demo-The Elisa test is a test done to grains to determine if they have been genetically modified. They are exposed to a solution that determines their genetic make-up. This test is done at elevators to determine price and what bin to store the grain in. When grain companies then sell these products to food manufacturers. The food companies have strict guidelines to follow for human consumption. (Conduct experiment in front of the class, and show finished sample.)

Conclusion:

Today we have talked a lot about human needs for the future. You are the future, and in order to sustain yourselves you will have to put these ideas and plans into use as well as come up with new agricultural ideas. There are thousands of options to explore, and we need people like you to do the job. The present chemists, biologists, and agriculturists are working hard to find more effective ways for everyone to live.

Appendix A

Materials Used

1.) Soybean Coloring Book cover

2.) Soybean booklet

3.) Bookmarks; Fun With Food and From A to Z... Soybeans-The Miracle Crop

4.) Biodiesel Handout, For the Global Environment

5.) Soybean Pamphlet, New Uses for Soybeans are Cropping Up… Everywhere!

6.) Biodiesel Pamphlet, The Intelligent Solution to Today's Energy Security and Environmental Issues

7.) Elisa Test

8.) BT Corn Samples and Non-BT Corn Samples

9.) European Corn Borer Moth Pictures

10.) Soybean, corn, wheat and rice products

Appendix B

References

1.) Pioneer Seed Company in Des Moines, Iowa

2.) Missouri Soybean Merchandising Council

3.) Interstate's Environmental Science and Technology, Jasper S. Lee, Ph.D., copyright 1997

4.) U.S. Department of Energy (DOE) by the National Renewable Energy Laboratory

5.) The National Biodiesel Board P.0. Box 104898, Jefferson City, MO 65110-4898

6.) The Show-Me Standards, Missouri Department of Elementary and Secondary Education

7.) Missouri Corn Growers Association website 3118 Emerald Lane, Jefferson City, MO 65109